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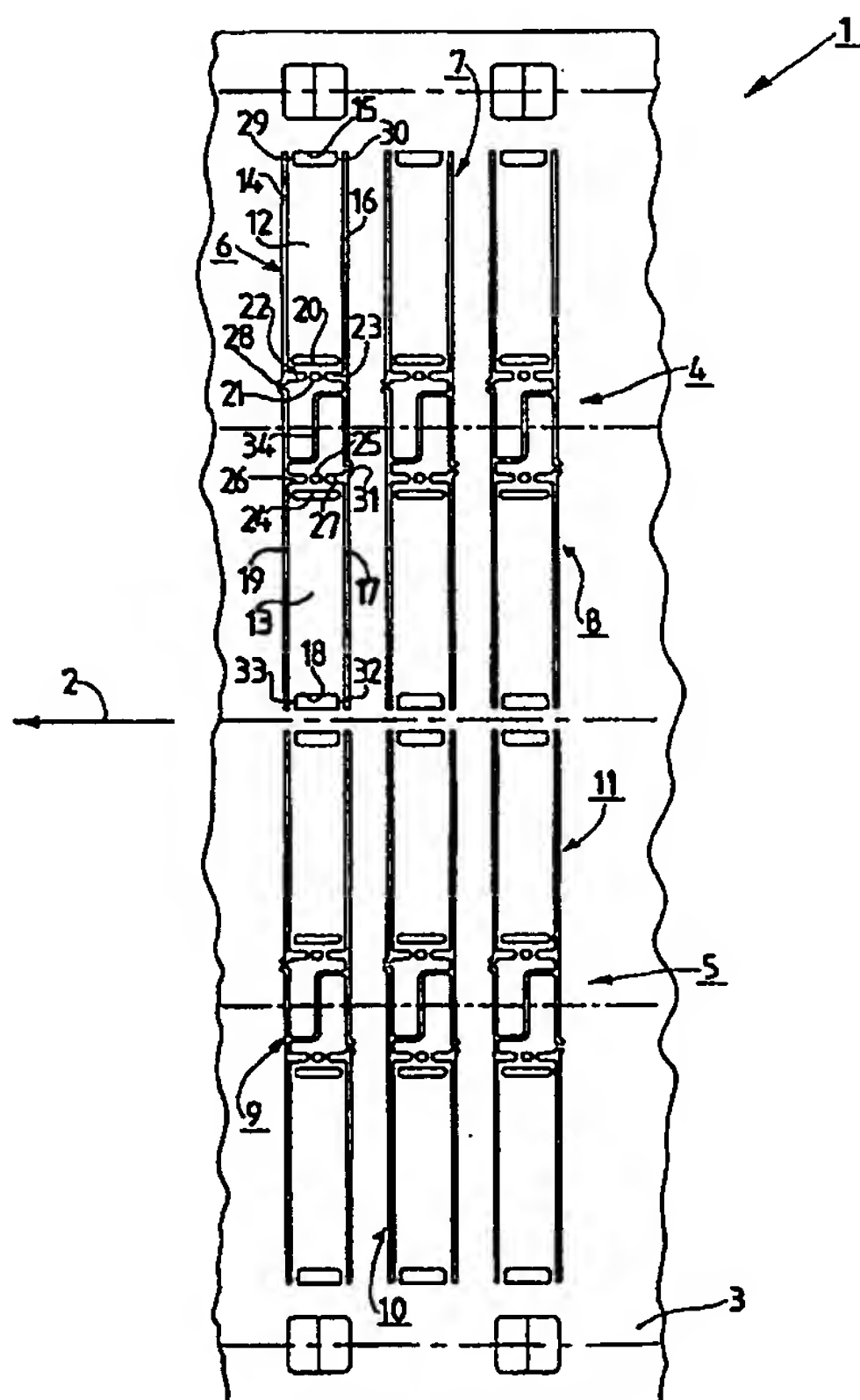
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- For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

(54) Title: **LEAD-FRAME CONFIGURATION FOR CHIPS**



(57) Abstract: In a lead-frame configuration (1), which has a frame base (3) and a multiplicity of lead-frames (6, 7, 8, 9, 10, 11) connected with the frame base (3) and intended to hold a chip each, each lead-frame (6, 7, 8, 9, 10, 11) has two connecting plates (12, 13), and each connecting plate (12, 13) is connected with the frame base (3) via connecting webs (28, 29, 30, 31, 32, 33) and the two connecting plates (12, 13) of each lead-frame (6, 7, 8, 9, 10, 11) delimit a bridging zone (34) which can be bridged using a chip and which is formed by only a narrow air gap (34) so that the two connecting plates (12, 13) of each lead-frame (6, 7, 8, 9, 10, 11) about each other directly without a further intermediate section of the lead-frame concerned.

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Lead-Frame Configuration for Chips

The invention relates to a lead-frame configuration with a frame base and multiplicity of lead-frames connected with the frame base, of which each lead-frame is intended to hold a chip, where each lead-frame has two connection plates of which each is intended to connect with a connection of a chip, where the two connection plates of each
5 lead-frame delimit a bridging zone which can be bridged using a chip.

Such a lead-frame configuration is known from patent document
US 5 005 282 A. With the known lead-frame configuration, for each lead-frame in the
10 bridging zone provided between two connection plates, there is a holder section of the lead-frame concerned mainly intended to hold a chip and the chip connected with the lead-frame is also embedded in a casting compound with which also the two connection plates and the holder section between the two connection plates are mechanically connected together.
Because of this structure there is a relatively large height in a direction vertical to the plane of
15 the lead-frame. Also in the known design the problem arises that the holder section lying between the two connecting plates requires a certain minimum space, which is disadvantageous in more and more applications and in particular for connecting chips that are as small as possible with a lead-frame in flip-chip technology or connecting the chip connections of this chip with the connection plates of a lead-frame in flip-chip technology.

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It is an object of the invention to eliminate the difficulties described above and to realize an improved lead-frame configuration.

To achieve the above mentioned object, in a lead-frame configuration
25 according to the invention in which no chips are yet provided, features according to the invention are provided so that such a lead-frame configuration according to the invention can be characterized in the following manner:

Lead-frame configuration designed strip-like with a frame base and a multiplicity of lead-frames connected with the frame base and lying next to each other in the

strip's longitudinal direction, of which each lead-frame is intended to hold a chip, where each lead-frame has two connection plates and between each connection plate and the frame base is provided at least one connecting web, and where each connecting plate is intended to connect with a connection of a chip and where the two connecting plates of each lead-frame
5 delimit a bridging zone which can be bridged using a chip, and where the two connecting plates of each lead-frame abut each other directly without an intermediate section of lead-frame and delimit an air gap as a bridging zone.

To achieve the above mentioned object, in a lead frame configuration according to the invention in which each lead-frame has a chip and each lead-frame is still
10 connected electrically conductively with the frame base, features according to the invention are provided so that such a lead-frame configuration according to the invention can be characterized in the following manner:

Lead-frame configuration designed strip-like with a frame base and a multiplicity of lead-frames connected with the frame base and lying next to each other in the
15 strip's longitudinal direction, of which each lead-frame is fitted with a chip, where each lead-frame has two connection plates and between each connection plate and the frame base is provided at least one connecting web, and where each connecting plate is connected with a connection of a chip and where the two connecting plates of each lead-frame delimit a bridging zone bridged by means of a chip, and where the two connecting plates of each lead-
20 frame abut each other directly without an intermediate frame section and delimit an air gap as a bridging zone.

To achieve the above mentioned object, in a lead frame configuration according to the invention in which each lead-frame is fitted with a chip and each lead-frame is no longer electrically conductively connected with the frame base, features according to
25 the invention are provided so that such a lead-frame configuration according to the invention can be characterized in the following manner:

Lead-frame configuration designed strip-like with a frame base and with a multiplicity of lead-frames connected with the frame base and lying next to each other in the strip's longitudinal direction, of which each lead-frame is fitted with a chip, where each lead-
30 frame has two connection plates and between each connection plate and the frame base was originally provided at least one connecting web and where the originally provided connecting webs have been disabled, and where each connecting plate is connected with a connection of a chip and where the two connecting plates of each lead-frame delimit a bridging zone bridged by means of a chip and where the two connecting plates of each lead-frame about

each other directly without an intermediate frame section and delimit an air gap as a bridging zone, and where for the lead-frames lying next to each other in the strip's longitudinal direction a connecting strip is provided running in the strip's longitudinal direction which is connected both with the frame base and with each of the frames lying next to each other in the strip's longitudinal linear direction.

The provision of the features according to the invention allows, in an easily implementable and constructionally simple manner, the lead-frame according to the invention to have a particularly compact and space-saving design at least in the area in which a chip can be or is connected with the lead-frame, and that in particular the distance between two connecting plates of this lead-frame, which connecting plates can be or are bridged by means of a chip is particularly small, which offers the great advantage that the distance between two chip connections each of which must be or is connected with such a lead-frame can be very small, which is true in the case of a particularly small chip which because of constant miniaturization is more and more common. In other words a lead-frame configuration according to the invention is ideally suitable in particular to hold very small chips with particularly small distances between chip connections which must be connected with the lead-frame of the frame configuration in flip-chip technology. A further great advantage of a lead-frame configuration according to the invention is that it is not necessary to embed the chip connected with the lead-frame into the casting compound, which means that a solution with a particularly small height can be achieved.

In the lead-frame configuration according to the invention the air gap provided between two connecting plates as a bridging zone can be designed so as to be rectilinear and run parallel to the strip's longitudinal direction of the lead-frame configuration. It has however proved very advantageous if the air gap is provided obliquely to the strip's longitudinal direction, where it has also proved particularly advantageous if the air gap is designed essentially S-shaped. This design is advantageous both with regard to the mechanical stress distribution in the bridging zone and with regard to the maximum flexibility in relation to the possible positions of the chip connections of the chips.

These and other aspects of the invention are apparent from the examples below and will be explained using these examples.

The invention will be further described with reference to three examples of embodiments shown in the drawings to which however the invention is not restricted.

Fig. 1 shows in a plan view a part of a lead-frame configuration according to an example of the invention in which lead-frame configuration with the lead-frames shown no chips are yet connected.

Fig. 2 shows in a similar manner to Fig. 1 part of a lead-frame configuration according to an example of the invention in which lead-frame configuration with the lead-frames shown a chip is already connected, and the lead-frame is shown still electrically conductively connected to the frame base.

Fig. 3 shows in a similar manner to Figs. 1 and 2 a lead-frame configuration according to an example of the invention in which lead-frame configuration with its lead-frames a chip is already connected and the lead-frames are electrically insulated from the frame base.

Fig. 1 shows a lead-frame configuration 1 in part. The lead-frame configuration 1 is designed strip-like and has a longitudinal direction of the strip that is indicated in Fig. 1 with an arrow 2. The lead-frame configuration 1 has a frame base 3. Connected with the frame base 3 are a multiplicity of lead-frames lying next to each other in the longitudinal direction of the strips 2. In the present case the lead-frames are arranged in two rows 4 and 5. Of the total lead-frames provided, Fig. 1 shows only six lead-frames 6, 7, 8, 9, 10 and 11 where lead-frames 6, 7 and 8 belong to the first row 4 and lead-frames 9, 10 and 11 to the second row 5. Each lead-frame 6 to 11 is intended to hold a chip. In the lead-frame configuration 1 according to Fig. 1, the chips are not yet connected with the lead-frame configuration 1 or with lead frames 6 to 11 of this configuration 1.

The structure of all lead-frames 6 to 11 is described in more detail below where this description is given only using the first-mentioned lead-frame 6.

Each lead-frame 6 to 11, i.e. also lead-frame 6, has two connecting plates 12 and 13. Connecting plates 12 and 13 are separated from the frame base 3 by a first narrow air gap 14 and a first passage 15 and a second narrow air gap 16 and a third narrow air gap 17 and a second passage 18 and a fourth narrow air gap 19. In the first connecting plate 12 are provided a full slot 20 and next to this a hole 21 and two half slots 22 and 23, where the first half slot 22 opens into the first narrow air gap 14 and the second half slot 23 into the second narrow air gap 16. In the second connecting plate 13 is also provided a full slot 24 and next to this a hole 25 and two half slots 26 and 27, of which the first half slot 26 opens into the fourth narrow air gap 19 and the second half slot 27 into the third narrow air gap 17. As a result of

providing the narrow air gaps 14, 16, 17 and 19 and passages 15 and 18, it is achieved that between the first connecting plate 12 and the frame base 3 lie a total of three connecting webs 28, 29 and 30, by means of which the first connection plate 12 is connected both mechanically and electrically conductively with the frame base 3. In a similar manner, between the second connecting plate 13 and the frame base 3 are provided three further connecting webs 31, 32 and 33 by means of which the second connecting plate 13 is connected with a frame base 3 both mechanically and electrically conductively. Each of the two connecting plates 12 and 13 is intended to connect with a chip connection of a chip.

The two connecting plates 12 and 13 of the lead-frame 6 delimit a bridging zone 34 which can be bridged using a chip. In the lead-frame configuration 1 the design is advantageously such that the two connecting plates 12 and 13 of the lead-frame 6 and hence of all other lead-frames 7, 8, 9, 10 and 11 abut each other directly without an intermediate section of the lead-frame 6 or the other lead-frames 7 to 11 and delimit a narrow air gap 34 as a bridging zone 34. In the design here the air gap 34 is provided so as to extend obliquely to the longitudinal direction of the strips 2. The air gap 34 is also essentially S-shaped as is clear from the Fig. 1.

Fig. 2 shows a lead-frame configuration 40 which is obtained by refining the lead-frame configuration 1 according to Fig. 1 and differs from the configuration 1 in Fig. 1 in that in the lead-frame configuration 40 in Fig. 2, a chip 41, 42, 43, 44, 45, 46 is connected with each lead-frame 6 to 11. The chips 41 to 46 are connected with their lead-frames 6 to 11 using "flip-chip technology", which means that each chip 41 to 46 with in this case its two chip connections 47, 48 and 49, 50 and 51, 52 and 53, 54 and 55, 56 and 57, 58 is placed in rotated position on the two connecting plates 12 and 13 of each lead-frame 6 to 11 and connected electrically conductively. The connection between the chip connections 47 to 58 and the connection plates 12 to 13 of each lead-frame 6 to 11 is achieved in this case using a thermo-compression process. Evidently the connection between the chip connections 47 to 58 and connecting plates 12 to 13 of each lead-frame 6 to 11 can also be made with other processes known per se.

Fig. 3 shows a further lead-frame configuration 60 which is achieved by refining the lead-frame configuration 40 in Fig. 2 and differs from the configuration 40 in Fig. 2 in that the lead-frames 6 to 11 and the chips 41 to 46 connected with these frames 6 to 11 are electrically insulated from the frame base 3. This is achieved in that the connecting webs 28, 29, 30 and 31, 32, 33 originally provided between the connecting plates 12 and 13 and the frame base 3 are disabled, in that those areas in which the said connecting webs 12 to

33 were provided are now provided with passages 61, 62, 63, 64 and 65 produced by a punching process.

If the passages 61 to 65 were produced without taking precautions this would mean that the two connecting plates 12 and 13 of each lead-frame 6 to 11 and the chips 41 to 46 connected with the two connecting plates 12 and 13 would have no further mechanical connection with the frame base 3, with the result that the two connecting plates 12 and 13 of each lead-frame 6 to 11 and the chips 41 to 46 connected with these would fall out of the frame base 3. To prevent this, in the lead-frame configuration 60 two connecting straps 66 and 67 are provided in the longitudinal direction 2 of the strip. The two connecting straps 66 and 67 are connected both with the frame base 3 and with each lead-frame 6 to 11 via connecting zones. These connecting zones are shown diagrammatically in Fig. 3 with circles 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81 indicated by dotted lines. Connecting zones 68 to 81 are produced of limited area and thus do not extend over the entire surface area of the connecting straps 66 and 67. Connecting straps 66 and 67 here consist of plastic and connecting zones 68 to 81 are produced by localized warming or heating of the connecting straps 66 and 67 made of plastic. Thus connecting zones 68 to 81 can be disabled as required, as is described in more detail below.

As, in the frame configuration 60 according to Fig. 3, no electrically conductive connection remains between connecting plates 12 and 13 of each lead-frame 6 to 11 and frame base 3, a test process can now be performed. In such a test process a contact electrode of a test device is brought into electrical connection with each connecting plate 12 and 13, whereupon using the test device a test is performed on the chips 41 to 46 connected to the plates 12 and 13.

The lead-frame configuration 60 shown in Fig. 3 can be passed on for further processing after completion of the necessary test procedure. For example the lead-frame configuration 60 according to Fig. 3 can be passed by the manufacturer of this lead-frame configuration 60 to a manufacturer of contactless communicating chip cards or a manufacturer of contactless RF labels or RF tags. The lead-frame configuration 60 according to Fig. 3 is advantageously passed on in roll form, which is particularly advantageous with regard to the easiest and most efficient transport.

In the company in which the lead-frame configuration 60 is processed further, the connecting straps 66 and 67 together with the connecting plates 12 and 13 connected with the connecting straps 66 and 67 via connecting zones 69, 71, 73, 76, 78 and 80, and together with the chips 41 to 46, are separated from the frame base 3, and in this separation

connecting zones 68, 70, 72, 74, 75, 77, 79 and 81 are disabled as the parts of the connecting straps 66 and 67 in these connecting zones remain on the frame base 3. These parts of the connecting straps 66 and 67 can however also be separated from the frame base 3.

Consequently in the company in which the lead-frame configuration 60 is processed further,

5 the connecting plates 12 and 13 connected with the first connecting strap 66 together with chips 41 to 43, and the connecting plates 12 and 13 connected with the second connecting strap 67 together with chips 44 to 46, are available for further processing. During this further processing a unit consisting of two connecting plates 12 and 13 and a chip 41 to 46, said unit often being known as a module, is inserted or placed in the end product to be produced.

10 Subsequently the two connecting plates 12 and 13 of each module are connected for example with the two connection contacts of a transfer coil of the end product concerned. After this connection of connecting plates 12 and 13 with the contacts of the transfer coil for example, the relevant connecting strap 66 is pulled off connecting plates 12 and 13, whereby then the connecting zones 69, 71 and 73 or 76, 78 and 80 are disabled as the areas of connecting
15 straps 66 and 67 lying within these connecting zones 69, 71, 73, 76, 78 and 80 remain connected with the connecting plates 12 and 13. These areas of the connecting straps 66 and 67 can however also be separated from the connecting plates 12 and 13.

It should here be pointed out that the connecting straps 66 and 67 and the connecting plates 12 and 13 connected with the connecting straps 66 and 67 via connecting
20 zones 69, 71, 73, 76, 78 and 80 together with chips 41 to 46 need not necessarily be separated from the frame base 3 by the further processing company but this could be done by the manufacturer of the lead-frame configuration 60. For example this separation could take place after connecting the connecting straps 66 and 67 with frame base 3 and with connecting plates 12 and 13 and after producing the passages 61 to 65 with a punching process.

25 It should be stated that the units consisting each of two connecting plates 12 and 13 and a chip 41 to 46 could also be processed further using conventional "pick & place" technology. Here the units consisting of two connecting plates 12 and 13 and a chip 41 to 46 are removed individually from the frame base 3 in that either the connecting straps 66 and 67 are divided in the narrow air gaps 14, 16, 17 and 19 or the units consisting of the two
30 connecting plates 12 and 13 and a chip 41 to 46 are removed from the connecting straps 66 and 67.

In the lead-frame configurations 1 and 40 and 60 described above, there is the great advantage that the two connecting plates 12 and 13 of each lead-frame 6 to 11 abut each other directly and are separated from each other only by a narrow air gap 34. This offers the

great advantage that the bridging zone 34 formed by the narrow air gap 34 can also be bridged using a particularly small chip 41 to 46 in flip-chip technology in which the distances between the chip connections are very small. Thus the lead-frame configurations 1, 40 and 60 are excellently suited for co-operating with particularly small chips. A further advantage in the lead-frame configurations 40 and 60 according to Figs. 2 and 3 is that with these configurations 40 to 60 it is not necessary to embed each chip 41 to 46 in a casting compound because the particularly narrow bridging zone 34 enables a sufficiently stable mechanical cohesion of the connecting plates 12 and 13 connected with the chip connections of each chip 41 to 46 to be obtained without casting compound and using only the chips 41 to 46 concerned.

CLAIMS:

1. A lead-frame configuration (1) designed strip-like with a frame base (3) and a multiplicity of lead-frames (6, 7, 8, 9, 10, 11) connected with the frame base (3) and lying next to each other in the strip's longitudinal direction (2), of which each lead-frame (6, 7, 8, 9, 10, 11) is intended to hold a chip, where each lead-frame (6, 7, 8, 9, 10, 11) has two connection plates (12, 13) and between each connection plate (12, 13) and the frame base (3) is provided at least one connecting web (28, 29, 30, 31, 32, 33), and where each connecting plate (12, 13) is intended to connect with a connection of a chip and where the two connecting plates (12, 13) of each lead-frame (6, 7, 8, 9, 10, 11) delimit a bridging zone (34) which can be bridged using a chip, and where the two connecting plates (12, 13) of each lead-frame (6, 7, 8, 9, 10, 11) abut each other directly without an intermediate section of the lead-frame (6, 7, 8, 9, 10, 11) and delimit an air gap (34) as a bridging zone (34).
2. A lead-frame configuration (1) as claimed in claim 1, where the air gap (34) runs obliquely to the strip's longitudinal direction (2).
3. A lead-frame configuration (1) as claimed in claim 1, where the air gap (34) runs essentially S-shaped.
4. A lead-frame configuration (40) designed strip-like with a frame base (3) and a multiplicity of lead-frames (6, 7, 8, 9, 10, 11) connected with the frame base (3) and lying next to each other in the strip's longitudinal direction (2), of which each lead-frame (6, 7, 8, 9, 10, 11) is fitted with a chip (41, 42, 43, 44, 45, 46), where each lead-frame (6, 7, 8, 9, 10, 11) has two connection plates (12, 13) and between each connection plate (12, 13) and the frame base (3) is provided at least one connecting web (28, 29, 30, 31, 32, 33), and where each connecting plate (12, 13) is connected with a chip connection (47, 48, 49, 50, 51, 52) of a chip (41, 42, 43, 44, 45, 46) and where the two connecting plates of each lead-frame (6, 7, 8, 9, 10, 11) delimit a bridging zone (34) bridged by means of a chip (41, 42, 43, 44, 45, 46), and where the two connecting plates (12, 13) of each lead-frame (6, 7, 8, 9, 10, 11) abut each

other directly without an intermediate section of the lead-frame (6, 7, 8, 9, 10, 11) and delimit an air gap (34) as a bridging zone (34).

5. A lead-frame configuration (40) as claimed in claim 4, where the air gap (34)
5 runs obliquely to the strip's longitudinal direction (2).

6. A lead-frame configuration (40) as claimed in claim 4, where the air gap (34)
runs essentially S-shaped.

10 7. A lead-frame configuration (60) designed strip-like with a frame base (3) and
with a multiplicity of lead-frames (6, 7, 8, 9, 10, 11) connected with the frame base (3) and
lying next to each other in the strip's longitudinal direction (2), of which each lead-frame (6,
7, 8, 9, 10, 11) is fitted with a chip (41, 42, 43, 44, 45, 46), where each lead-frame (6, 7, 8, 9,
10, 11) has two connection plates (12, 13) and between each connection plate (12, 13) and
15 the frame base (3) was originally provided at least one connecting web (28, 29, 30, 31, 32,
33) and where the originally provided connecting webs (28, 29, 30, 31, 32, 33) have been
disabled, and where each connecting plate (12, 13) is connected with a chip connection (47,
48, 49, 50, 51, 52) of a chip (41, 42, 43, 44, 45, 46) and where the two connecting plates (12,
13) of each lead-frame (6, 7, 8, 9, 10, 11) delimit a bridging zone (34) bridged by means of a
20 chip (41, 42, 43, 44, 45, 46) and where the two connecting plates (12, 13) of each lead-frame
(6, 7, 8, 9, 10, 11) about each other directly without an intermediate section of the lead-frame
(6, 7, 8, 9, 10, 11) and delimit an air gap (34) as a bridging zone (34), and where for the lead-
frames (6, 7, 8, 9, 10, 11) lying next to each other in the strip's longitudinal direction (2) a
connecting strip (66, 67) is provided running in the strip's longitudinal direction (2) which is
25 connected both with the frame base (3) and with each of the frames (6, 7, 8, 9, 10, 11) lying
next to each other in the strip's longitudinal direction (2).

8. A lead-frame configuration (60) as claimed in claim 7, where the connecting
strap (66, 67) is connected both with the frame base (3) and with each of the lead-frames (6,
30 7, 8, 9, 10, 11) lying next to other in the strip's longitudinal direction (2) via a multiplicity of
connecting zones (68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81) which can be
disabled.

9. A lead-frame configuration (60) as claimed in claim 7, where the air gap (34) runs obliquely with respect to the strip's longitudinal direction (2).

10. A lead-frame configuration (60) as claimed in claim 7, where the air gap (34)
5 runs essentially S-shaped.

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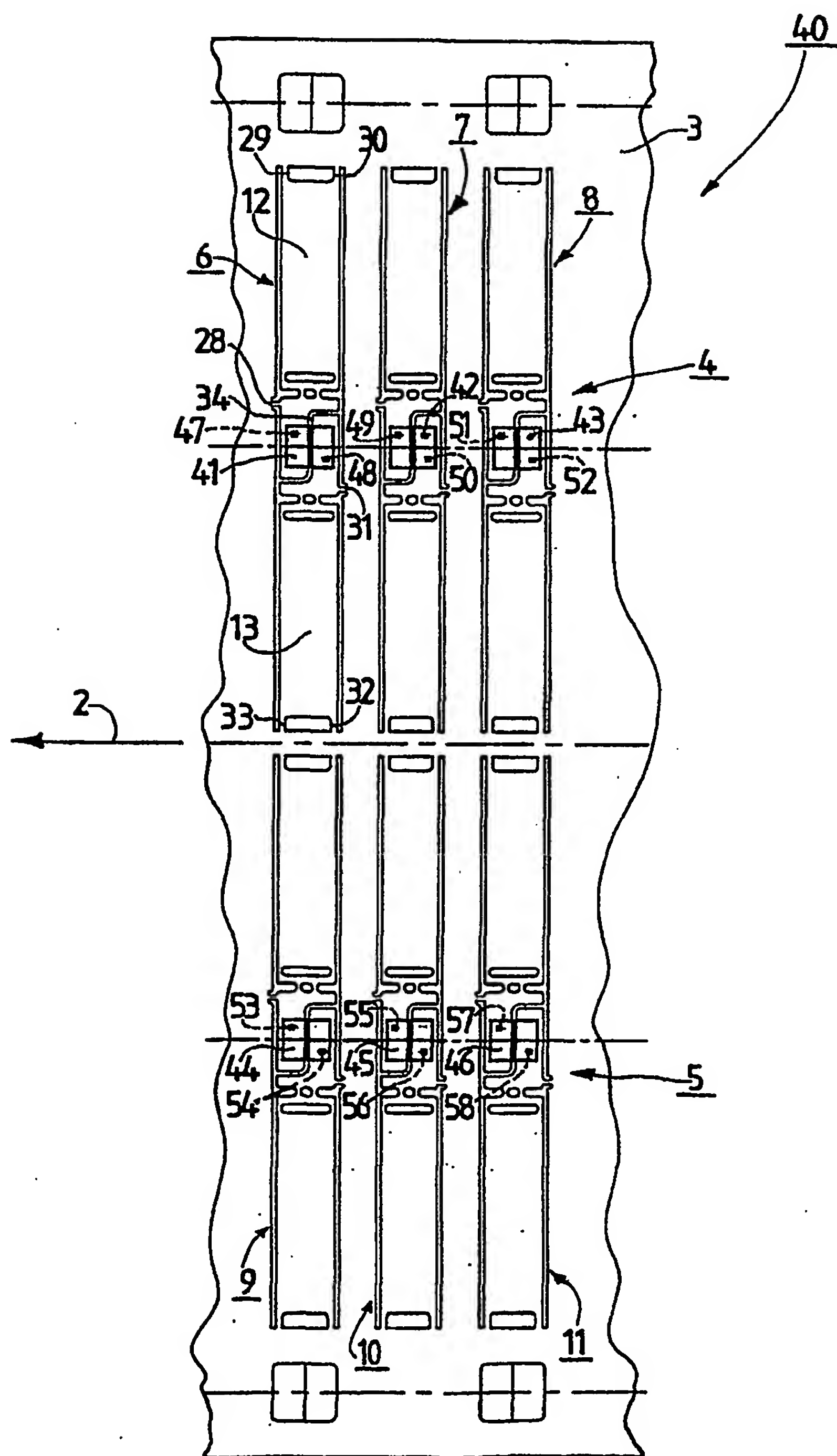


FIG.2

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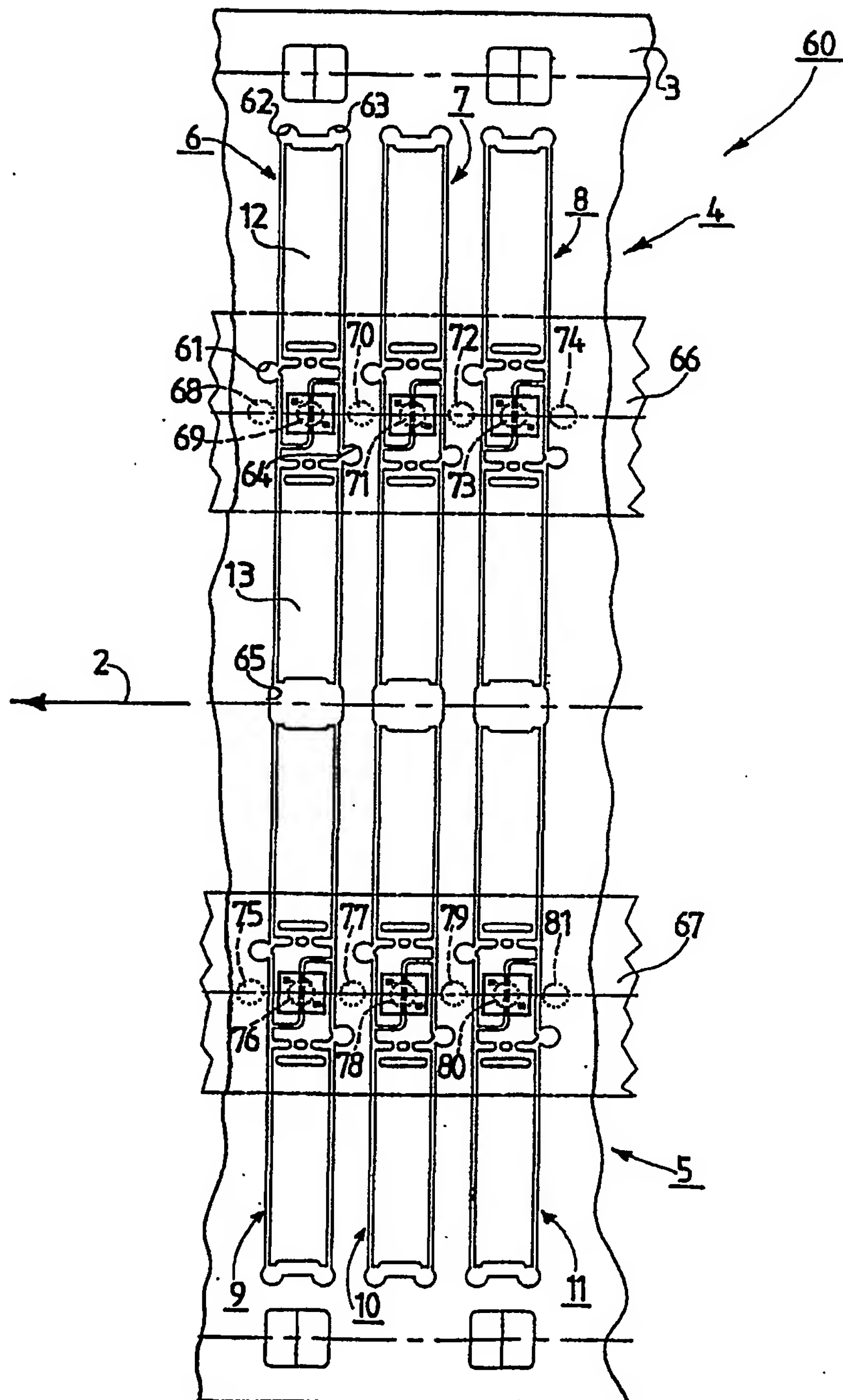


FIG.3

INTERNATIONAL SEARCH REPORT

Inter Application No
PCT/IB 02/01734

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G06K19/077

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 G06K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 00 30210 A (MOTOROLA INC) 25 May 2000 (2000-05-25)	1,2,4,5
A	page 2, line 8 - line 30 page 3, line 14 - line 31 figures 1-3,6	3,7-10
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A	column 3, line 13 -column 4, line 10 figures 2,3	3,7-10
A	US 5 005 282 A (ROSE RENE) 9 April 1991 (1991-04-09) cited in the application the whole document	1,4,7

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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Date of the actual completion of the international search

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/IB 02/01734

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